AFFECTIVE DEVELOPMENT FROM LATE CHILDHOOD TO LATE ADOLESCENCE: TRAJECTORIES OF MEAN-LEVEL CHANGE IN NEGATIVE AND POSITIVE AFFECT

BY

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ABSTRACT

Negative and positive emotions comprise basic elements of human experience and are associated with outcomes across a range of domains, spanning physical and emotional health, behavioral functioning, and psychological wellbeing. The present study used latent growth curve modeling (LGCM) to map trajectories of subjective mean-level negative (NA) and positive affect (PA) from late childhood to late adolescence in a sample of 652 community youth age 10 to 18 years (56.4% female) recruited in 3rd, 6th, and 9th grade cohorts. Youth affect was assessed repeatedly via self-report over three years in an accelerated longitudinal cohort design (6 total assessment points). Results of LGCM analyses indicate that adolescence is characterized by declines in PA and increases in NA, with girls experiencing greater mean-level NA than boys beginning in grade 6. Findings contribute foundational descriptive information, illustrating normative trajectories of mean-level affect across a critical period of human development.

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CHAPTER 1: INTRODUCTION

Emotions comprise a fundamental aspect of human experience, with implications for such diverse aspects of functioning as cognition, motivation, and achievement (see Ekman & Davidson, 1994). Despite emotion's integral role in shaping psychological outcomes across the lifespan, limited research has explored developmental trajectories of emotional experience, particularly as they unfold across earlier periods in the life course. The transition from late childhood through adolescence has sometimes been characterized as a period of emotional tumult (i.e., "storm and stress"), although the extent to which most youth experience such negativity has been contested (e.g., Hollenstein & Lougheed, 2013). Moreover, this developmental period features opportunities for youth to establish enduring patterns of behavioral and emotional functioning. Adolescence may represent an important foundational period for the development of long-term health and wellbeing (Sawyer et al., 2012), as well as a period of heightened susceptibility to aberrant affective functioning (Kann et al., 2014; Merikangas et al., 2010). Given the recognized importance of emotional experience, it is surprising that the field lacks basic knowledge regarding the descriptive patterning of youths' trait affective experience. Research is needed to examine developmental trajectories of mean-level change in positive affect (PA) and negative affect (NA) from late childhood to late adolescence. Elucidating normative patterns of mean-level change in adolescent affective experience is essential to clarifying core mood processes typifying emotional development.

Trait affect reflects relatively enduring tendencies toward the experience of certain emotion states (e.g., fearfulness, joy, exuberance). Structural models of emotion organize these discrete experiences into two higher order factors: negative affect (NA) and positive affect

(PA; Watson, 2000). NA, reflecting the experience of such emotions as fear, guilt, and sadness, demonstrates relationships with outcomes including health complaints (Pressman, Gallagher, & Lopez, 2013), substance abuse (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004), and eating pathology (Stice, 2001). PA, reflecting the experience of such emotions as cheerfulness, interest, and self-assuredness, has been found to facilitate effective coping and recovery from stress (Tugade & Fredrickson, 2004), as well as potentiate processes of wellbeing, including resilience (Cohn, Fredrickson, Brown, Mikels, & Conway, 2009), interpersonal closeness (Ramsey & Gentzler, 2015) and physical health (Dockray & Steptoe, 2010; see Lyubomirsky, King, & Diener, 2005 for review).

Some limited research has illustrated how NA and PA may develop over the childhood years. Specifically, research indicates linear change in PA and NA from late infancy to middle childhood; in a longitudinal design, Olino et al. (2011) observed increases in PA and decreases in NA among children followed from late infancy to age nine. Research is needed, however, to extend knowledge of developmental trajectories beyond age nine and into adolescence. Such research may facilitate identification of key leverage points in development to promote affective health and positive adaptation.

Some limited inferences regarding normative patterns of trait affect in adolescence can be drawn from studies examining related constructs. Trajectories of personality development during this developmental stage show patterns of mean-level change in neuroticism and extraversion, which are related to the experience of NA and PA, respectively (Watson, 2000). In a large, cross-sectional study of mean-level personality trait development across the lifespan, Soto, John, Gosling, and Potter (2011) found positive trends in neuroticism (suggesting increasing NA) and negative trends in extraversion (suggesting decreasing PA) between ages 10 and 17. In a longitudinal study of personality development from age 12 to 22, Borghuis et al. (2017) observed quadratic growth in extraversion and neuroticism, such that these traits demonstrated “U” (in the case of extraversion) and inverted “U” (in the case of neuroticism) shaped trajectories. While there were no gender differences in extraversion, curvilinear growth in neuroticism was observed among girls only; among boys, neuroticism remained stable (Borghuis et al., 2017). It is important to note, however, that personality traits are not isomorphic with youths’ affective experiences; personality traits comprise cognitive and behavioral tendencies in addition to trait emotion (Caspi, 1998).

These personality trait development findings are consistent with experience sampling method (ESM) research assessing trends in state affect across adolescence. Relative to *trait* affect, which reflects relatively enduring individual differences in emotionality, *state* affect captures more transient emotional experience, reflecting fluctuating “streams of affect” (Watson, 2000). ESM research indicates declines in global mood (Larson & Lampman-Petraitis, 1989; Larson, Moneta, Richards, & Wilson, 2002), and reductions in PA, specifically (Weinstein, Mermelstein, Hankin, Hedeker, & Flay, 2007) during adolescence. Further, both the ESM and personality literatures find gender differences in development across adolescence. Specifically, boys demonstrate steeper declines in PA/extraversion, and girls report more marked increases in NA/neuroticism (Soto et al, 2011; Weinstein et al, 2007).

This extant literature informs hypotheses regarding potential NA and PA trajectories spanning late childhood to late adolescence; however, constructs assessed in personality and ESM research are conceptually distinct from trait affect, and developmental trends in trait affect across adolescence remain unknown. Longitudinal research is needed to build upon these findings by examining developmental trends in trait NA and PA from late childhood through adolescence, and to assess moderation by gender.

The Present Study

The present study investigated developmental trajectories of PA and NA using longitudinal, repeated measures of trait affect among 652 community youth recruited through the Gene, Environment, and Mood (GEM) Study (see Hankin et al., 2015). Youth were recruited in grades three, six, and nine, and prospectively followed for three years using an accelerated longitudinal cohort design. NA and PA were assessed every 18 months using the Positive and Negative Affect Scale for Children (PANAS-C), a well-validated self-report measure of trait affect (Laurent et al., 1999). As children's self-report of PANAS-C affect is not optimally reliable until approximately grade 4 (Laurent et al., 1999; Veronese & Pepe, 2017), the present study mapped affective trajectories spanning ages 10 to 18. Further, the present study examined gender differences in affective trajectories across adolescent development.

Given the dearth of research exploring longitudinal trends in mean-level affective change across adolescence, we did not make a priori hypotheses regarding expected shapes of developmental growth; however, based on ESM and personality findings, we expected to observe overall increases in mean-level NA and overall decreases in mean-level PA from late childhood to late adolescence. We additionally expected a gender difference to emerge around mid-adolescence, whereby we expected to observe steeper increases in NA among girls and steeper decreases in PA among boys.

CHAPTER 2: METHOD

Participants and Procedures

Participants comprised 652 youth recruited in third (*N* = 181), sixth (*N* = 248), and ninth (*N* = 223) grade cohorts (age 8-16 at baseline, M_{age} = 11.95, SD_{age} = 2.36, 56.4% female). Inclusion criteria included English language fluency, absence of autism or psychotic disorder diagnosis, and IQ > 70 as assessed via parent report. Sample demographics were approximately representative of the ethnic and racial characteristics of the United States population (69.0% White, 11.0% African American, 8.7% Asian/Pacific Islander, 6.0% multi-racial, 5.2% other racial identity, with 12.3% of the total sample identifying as having a Latinx ethnic identity). Further details regarding sampling procedures and participant characteristics are described in Hankin et al. (2015).

Youth were invited to the laboratory to complete a battery of measures every 18 months for 3 years. Participants completed the PANAS-C at each time point, yielding 3 assessment points per participant (e.g., baseline [T1], 18 months [T2], and 36 months [T3]). As we articulate in the measures section, the PANAS-C demonstrates suboptimal psychometric properties among children prior to the 4th grade; the measure has a relatively advanced reading level, and research indicates that some affect adjectives may not be well understood by children until grade 4 (Veronese & Pepe, 2017; Laurent et al., 1999). For these reasons, we did not include the first assessment point for the 3rd grade cohort in the analysis. Thus, six total assessment points of the PANAS were included in the present analyses, spanning grades 4 through 12 using an accelerated longitudinal cohort design, thereby facilitating analyses of developmental trajectories from age 10 to age 18 (see Figure 1). Of the total sample, 85.4% (*N* = 557) participants completed measures at T2, and 80.4% ($N = 524$) completed measures at T3; 75.3% ($N = 491$) of participants completed measures at all three time points. Participants who completed all time points were not significantly different from participants that did not complete all time points on measures of NA or PA at any time point (all ps > .05).

Measures

Demographics. At baseline, participants completed a brief questionnaire assessing basic demographic information, including child age, gender, racial/ethnic identity, and socioeconomic status.

Trait Affect: PA and NA. Trait affect was assessed every 18 months using the Positive and Negative Affect Scale for Children (PANAS-C; Laurent et al., 1999). The PANAS-C is a reliable and commonly used questionnaire measure assessing youths' experience of 27 discrete emotion states (e.g., "interested," "sad," "excited") on a 5-point Likert scale from (1) *very slightly or not at all* to (5) *extremely*. The PA subscale comprises 12 items assessing youths' experience of such positive emotion states as "cheerful," "delighted," and "calm." The NA subscale comprises an analogous 15 items assessing youths' feelings of such emotion states as "frightened," "ashamed," and "upset." PA and NA subscales of the PANAS-C demonstrate strong psychometric properties among adolescent samples and evidence good convergent and discriminant validity in both clinical (Hughes & Kendall, 2009) and community samples (Laurent et al., 1999). Scale authors suggest that affect adjectives may not be well understood by children prior to achieving a grade 4 reading level (Laurent et al., 1999). Thus, PANAS-C data was not included in analyses for participants prior to grade 4.

Overall, PA and NA subscales demonstrated good reliability at all assessment points in the present sample (α = .86-.89 and .89-.91 for PA and NA, respectively).

CHAPTER 3: RESULTS

Preliminary Analyses

Study hypotheses and analytic plan were pre-registered on the Open Science Framework before data were released for analysis (project link: osf.io/hj96u). Descriptive statistics are reported in Table 1. In addition, we descriptively plotted the means of PA and NA for each grade cohort, and across each assessment time point, to illustrate affective developmental trends from age 10 to 18 for the sample as a whole (Figure 2), as well as separately by gender (Figure 3).

Correlations among primary variables in the overall sample, as well as in each cohort independently, are described in Table 2. Consistent with prior theory and research (Watson, 2000), in the sample overall, NA and PA were only moderately correlated with one another at each time point (r = -.17 to -.27). Measures of affect were moderately correlated with themselves across time (r = .25 to .50). Age at baseline generally correlated negatively with PA and positively with NA across time points (see Table 1). These preliminary age trends provide initial evidence for patterns of affective change from late childhood through adolescence.

Prior to primary analyses, Little's MCAR test was conducted to assess for patterns of systematic missingness in the data. Results of Little's test were nonsignificant for all cohorts ($\chi^2(7) = 2.61$, $p = .919$ for grade 3, $\chi^2(19) = 22.25$, $p = .272$ for grade 6, $\chi^2(16) = 22.58$, $p = .125$ for grade 9), indicating that data were missing completely at random. As described next, the following analyses more formally evaluated latent growth models for PA and NA.

Latent Growth Curve Modeling (LGCM) Data Analytic Plan

Accelerated longitudinal cohort designs assume that data sampled from adjacent, overlapping age cohorts over time-limited longitudinal intervals can be linked to approximate a single, continuous growth curve (Duncan, Duncan, & Hops, 1996). Thus, such a design assumes equivalence of data collected from disparate cohorts at any singular stage of development. To determine if the accelerated longitudinal cohort design could be validly used to examine trajectories of mean-level NA and PA from age 10 to 18, analyses were first conducted to evaluate whether PANAS affect scores differed significantly between cohorts at overlapping assessment points (see Figure 1). T-tests were conducted to compare 3rd graders' scores at 36 months and 6th graders' scores at baseline, as well as 6th graders' scores at 36 months and 9th graders scores at baseline. Assumptions of the accelerated longitudinal cohort design were not met in the present study; NA subscale scores at overlapping time points differed significantly between 3rd graders and 6th graders ($d = .43$, $t(403) = -4.14$, $p < .001$) and 6th graders and 9th graders ($d = .28$, $t(423) = -2.86$, $p = .004$). PA subscale scores did not differ at the point of overlap between 3rd vs 6th graders ($d = .08$, $t(403) = -.81$, $p = .420$) but did significantly differ at the point of overlap between 6th graders and 9th graders ($d = .26$, $t(424) = -2.71$, $p = .007$). Thus, data were analyzed separately for each cohort.

Developmental trajectories were analyzed with LGCM using the lavaan package for Structural Equation Modeling (SEM) in R (Rosseell, 2012; R Core Team, 2017) using full information maximum likelihood (FIML) estimation for missing data. We first fit an unconditional means (no-growth) model to the data, followed by a linear growth model. Goodness of fit for each model was assessed using convergence across multiple fit indices, including Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), and Comparative Fit Index (CFI), consistent with recommendations proposed by Hu and Bentler (1999). Specifically, good fit was indicated by RMSEA < .06, SRMR < .08, and CFI > .95, and acceptable fit was indicated by RMSEA < .08 and CFI > .90

(Hu & Bentler, 1999). As the introduction of additional slope terms result in models that are no longer nested, chi-squared tests of difference were not appropriate to compare models. Thus, models demonstrating good fit according to convergence across RMSEA, SRMR, and CFI fit indices were subsequently compared on Akaike Information Criteria (AIC) and Bayesian Information Criteria (BIC) in order to determine the best fitting model, with lower values indicating better fit. To assess whether initial levels (i.e., intercepts) or rates of change (i.e., slopes) of NA and PA are different among boys and girls, gender was included as a predictor of the intercept and slop factors in the best fitting models for each cohort.

PA Trajectories

Grade 3 cohort. As shown in Table 3, the no-growth model with the two time-points of PANAS data assessed at 18- and 36-months (approximately 4th and 6th grades) demonstrated acceptable fit to the grade 3 data across most indices (CFI = .95, RMSEA = .10, SRMR = .04). Parameter estimates are reported in Table 4. Gender did not predict model intercept (β = -.02, p = .876), indicating no gender differences in mean-level PA in the grade 3 cohort.

Grade 6 cohort. Among the grade 6 cohort, a linear model demonstrated good fit to the three time points of data across fit indices (CFI = 1.00, RMSEA = .00, SRMR = .01; see Table 3). As reported in Table 4, the linear slope was negative (b = -1.58, $p < .001$), indicating decreasing trajectories of PA from grade 6 to grade 9. Gender predicted model intercept (β = .21, p = .018) such that girls demonstrated higher initial levels of PA relative to boys in the grade 6 cohort. Gender did not predict model slope (β = -.13, p = .253), indicating that rates of change in PA do not significantly differ between boys and girls across this developmental period.

Grade 9 cohort. As in the 6th grade cohort, a linear model demonstrated good fit to the grade 9 data covering three time points from 9th to 12th grades across fit indices (CFI = 1.00, RMSEA = .00, SRMR = .01; see Table 3). The linear slope term was again negative (b = -1.78, p < .001), indicating persisting declines in PA from grade 9 to grade 12. Gender did not significantly predict model intercept (β = -.03, p = .732) or slope (β = -.16, p = .153), indicating no gender differences in initial levels or rates of change in PA between grades 9 and 12.

NA Trajectories

Grade 3 cohort. A no-growth model demonstrated acceptable fit to the two time-points of PANAS data assessed at 18- and 36-months (approximately 4th and 6th grades) across most indices (CFI = .98, RMSEA = .10, SRMR = .03; see Table 3). Parameter estimates are reported in Table 4. Gender did not significantly predict model intercept (β = .13, p = .347), indicating no gender differences in grade 3 NA.

Grade 6 cohort. As shown in Table 3, both no-growth (CFI = .94, RMSEA = .07, SRMR = .06) and linear models (CFI = .97, RMSEA = .10, SRMR = .03) demonstrated acceptable fit to the three time points across fit indices. AIC values were comparable across models, and BIC values indicated an advantage for the no-growth model (ΔAIC = -.64, ΔBIC = -11.18). As the linear slope term was not significantly different from zero (b = -.06, p = .870), the no-growth model was retained as the best-fitting model for parsimony. Gender significantly predicted the intercept (β = .34, p < .001), such that girls demonstrated higher levels of mean NA than boys within the grade 6 cohort.

Grade 9 cohort. Among the grade 9 cohort, both no-growth (CFI = .99, RMSEA = .04, SRMR = .05) and linear models (CFI = 1.00, RMSEA = .02, SRMR - .02) demonstrated good fit to the three time points spanning 9th to 12th grades across fit indices (see Table 3). AIC values were comparable across models, and BIC values indicated an advantage for the no-growth model (ΔAIC = -1.71, ΔBIC = -11.92). As the linear slope term was not significantly different from zero (b = -.75, p = .071), the no-growth model was again retained as the best-fitting model for parsimony. As in the grade 6 cohort, gender predicted the intercept (β = .26, *p* = .001), such that girls reported higher levels of mean NA than boys across late adolescence.

Cohort Age-Related Effects on PA and NA Trajectories

Age associations with NA and PA (Table 1) as well as the descriptive mean trajectories depicted in Figure 2 suggest that levels of NA decrease and PA increases from middle childhood to late adolescence. To more formally examine developmental changes in levels of NA and PA over time, additional analyses were conducted to probe effects of grade cohort on trajectories of growth and construct a more complete representation of mean-level change in trait affect from late childhood to late adolescence. Using the overall sample (i.e., data collapsed across cohorts), grade cohort was entered as a predictor of latent growth factors (i.e., intercept and slope) in PA and NA, respectively.

Positive affect. A linear model including grade cohort as a predictor of intercept and slope demonstrated good fit to the data (CFI = 1.00, RMSEA = .00, SRMR = .01). Grade cohort predicted the intercept (β = .07, p = .013) but not the slope (β = -.03, p = .372), indicating that initial levels of PA mildly increased across development cohorts; however, all cohorts demonstrated consistent declines in mean-level PA across development.

Negative affect. A no-growth model including grade cohort as a predictor of intercept and slope demonstrated good fit to the collapsed data (CFI = .98, RMSEA = .04, SRMR = .03). Grade cohort predicted model intercept (β = .14, p < .001) such that mean-levels of NA increased across successive cohorts.

CHAPTER 4: DISCUSSION

Despite the importance of affect to a wealth of developmental outcomes, mean-level trajectories of PA and NA had not yet been mapped across the transition from childhood to late adolescence, a time of purported emotional upheaval (i.e., “storm and stress”). Present findings illuminate developmental trends in these affective trajectories and show that adolescence is characterized by steady declines in PA and mean-level increases in NA from childhood to late adolescence. Additionally, youths’ gender influences average affective development such that girls experience higher mean levels of NA relative to boys beginning in adolescence. Taken together, results add new descriptive trajectory information to the literature by showing marked affective changes from childhood to late adolescence.

As illustrated in Figure 2, as youth transition through adolescence, they experience decreasing trajectories of mean-level PA and increasing trajectories of mean-level NA. Specifically, results of LGCM analyses indicate a negative linear trajectory of PA across this developmental period. Further, latent growth curve models indicated mean-level increases in NA across successive development cohorts, such that mean-level NA increased from late childhood to late adolescence. Overall, descriptive mean-level data, correlational analyses, and latent growth curve models converge to suggest that adolescent development is characterized by decreasing PA and increasing NA.

The present study builds on prior longitudinal work investigating developmental trajectories in affect, extending this work from late childhood to late adolescence. The present findings indicate that affective trajectories undergo a normative reversal in early adolescence. Whereas Olino et al. (2011) found linear trends of increasing PA and decreasing NA in their early childhood sample, present results indicate declining PA and increasing NA beginning around early adolescence. Trajectories of mean-level trait affect detected in the current study are generally consistent with trends observed in literature on related constructs among adolescent youth. ESM studies probing developmental patterns in state affect have indicated declines in subjective global mood state, broadly (Larson & Lampman-Petraitis, 1989, Larson et al., 2002), and state PA, specifically (Weinstein et al., 2007), across adolescence. Similarly, studies of personality trait development have indicated increasing neuroticism (associated with NA) and decreasing extraversion (associated with PA) across this period (Soto et al., 2011; Borghuis et al., 2017).

Of note, increases in NA were observed between successive cohorts, but significant linear slopes in NA were not detected in the present study. Indeed, no-growth models most parsimoniously captured NA trajectories within each cohort independently, although correlational findings indicate positive associations between age and NA in the sample overall. Variance in intercept and linear slope estimates within NA models suggest that some youth may be experiencing increasing NA while others are experiencing stable or declining NA. Future work should evaluate predictors of individual differences in NA trajectories and further clarify developmental patterns of NA growth.

The present study additionally probed gender differences in affective change. Gender effects were observed in NA such that girls experienced consistently higher levels of NA than boys beginning in grade 6, or approximately age 12. Gender differences in PA development were less consistent; gender differences were observed among the grade 6 cohort only, such that girls reported higher initial levels of PA than boys in grade 6 before trajectories again converged among youth in the grade 9 cohort. Results are consistent with literature indicating gender differences in rates of internalizing among adolescents, with girls demonstrating higher rates of psychological disorders associated with elevated NA, such as social anxiety, generalized anxiety disorder, and depression in adolescence (Van Oort, Greaves-Lord, Verhulst, Ormel, Huizink, 2009; Burnstein et al., 2011; Hankin et al., 1998).

The present findings should be interpreted in the context of several limitations. Assumptions of the accelerated longitudinal cohort design were not met in the present sample, preventing modeling of continuous affective trajectories spanning age 10 to age 18. While cohort-based analyses elucidated developmental trajectories of mean-level NA and PA from late childhood to late adolescence in the present study, future research should aim to map such trajectories continuously across a sample of youth followed longitudinally across this period of development. Additionally, researchers should aim to assess trait affect with sufficient frequency to test patterns of curvilinear growth, as personality research suggests quadratic trends in related constructs across adolescence (Borghuis et al., 2017). Moreover, by analyzing each cohort separately, present analyses could not directly estimate gender-specific trajectories; future work should aim to map trajectories of affect separately for boys and girls, in addition to assessing for gender differences in parameter estimates.

Despite these limitations, the present study demonstrates a number of notable strengths and represents an important addition to the extant literature on emotional development. LGCM analyses permitted sophisticated modeling of affective trajectories among a large sample of community youth. Further, the present longitudinal, repeated measures design spanning late childhood to late adolescence provides rich insight into patterns of change in mean-level PA and NA across a critical period of human development, elucidating trends in normative emotional experience. Importantly, by empirically mapping mean-level trajectories of NA and PA across ages 10 to 18, the present study addresses a critical gap in our knowledge of emotional development across a vulnerable period of the lifespan.

Despite historical interest in adolescence as a period of "storm and stress," developmental trajectories of mean-level trait NA and PA across adolescence have not been studied. The present study mapped such trajectories; findings indicate that the period spanning late childhood to late adolescence is characterized by declining PA and increasing NA, with girls experiencing higher levels of mean NA than boys beginning in early adolescence. By mapping affective trajectories from late childhood to late adolescence, the present study illustrates normative trends adolescents' emotional experience, contributing fundamental descriptive information to our knowledge of human emotional development.

CHAPTER 5: TABLES

Table 1

Means (and SDs) by Grade Cohort and Gender

	Overall *M*(*SD*)	Girls *M*(*SD*)	Boys *M*(*SD*)	*t*(df)	*p*
Grade 3 Cohort					
Age	10.63 (.52)	10.58 (.55)	10.70 (.46)	1.63 (170.60)	.106
PA T1	-	-	-	-	-
PA T2	45.33 (9.02)	45.23 (9.17)	45.43 (8.91)	.14 (169)	.891
PA T3	44.17 (8.75)	44.28 (8.91)	44.06 (8.63)	-.16 (156)	.875
NA T1	-	-	-	-	-
NA T2	23.91 (8.15)	24.72 (8.83)	23.02 (7.28)	-1.36 (168)	.175
NA T3	22.96 (7.54)	23.08 (7.04)	22.83 (8.10)	-.21 (156)	.833
Grade 6 Cohort					
Age	11.75 (.71)	11.77 (.69)	11.73 (.73)	-.40 (246)	.693
PA T1	44.90 (8.25)	45.79 (8.34)	43.62 (8.00)	-2.04 (243)	.043
PA T2	43.69 (8.16)	44.60 (7.98)	42.36 (8.28)	-1.96 (206)	.052
PA T3	41.63 (8.77)	41.75 (9.08)	41.46 (8.35)	-.23 (200)	.818
NA T1	26.54 (8.53)	27.73 (9.10)	24.86 (7.37)	-2.63 (243)	.009
NA T2	25.31 (8.53)	26.73 (9.18)	23.22 (7.04)	-3.11 (202.18)	.002
NA T3	26.48 (9.29)	28.42 (10.09)	23.71 (7.19)	-3.88 (199.81)	.000
Grade 9 Cohort					
Age	14.66 (.62)	14.62 (.63)	14.71 (.60)	1.14 (221)	.095
PA T1	43.88 (8.08)	43.78 (7.77)	44.00 (8.51)	.20 (221)	.696
PA T2	41.90 (8.61)	41.11 (8.63)	42.94 (8.52)	1.41 (176)	.161
PA T3	40.25 (7.71)	39.45 (7.51)	41.33 (7.90)	1.55 (162)	.124
NA T1	29.29 (10.38)	31.20 (10.92)	26.78 (9.08)	-3.29 (218.28)	.001
NA T2	28.11 (8.61)	29.59 (9.14)	26.14 (7.46)	-2.77 (175.90)	.006
NA T3	27.68 (9.67)	28.60 (9.84)	26.41 (9.34)	-1.44 (162)	.153

Note. Grade 3 NA and PA at T1 not included in analyses (see Methods for further details); Grade 3 Age refers to child age at T2; NA = negative affect; PA = positive affect

Table 2

Correlations between Primary Variables

	2	3	4	5	6	7
Overall Sample						
1. Age at T1	-.05	.14	-.14	.16	-.16	.20
2. Positive Affect T1	---	-.17	.45	-.06	.34	-.10
3. Negative Affect T1		---	-.11	.46	-.10	.32
4. Positive Affect T2			---	-.18	.50	-.09
5. Negative Affect T2				---	-.16	.43
6. Positive Affect T3					---	-.27
7. Negative Affect T3						---
Grade 3 Cohort						
1. Age at T1	---	---	-.06	-.13	.01	.08
2. Positive Affect T1	---	---	---	---	---	---
3. Negative Affect T1		---	---	---	---	---
4. Positive Affect T2			---	-.09	.46	-.02
5. Negative Affect T2				---	-.05	.18
6. Positive Affect T3					---	-.10
7. Negative Affect T3						---
Grade 6 Cohort						
1. Age at T1	.05	-.08	-.14	.16	-.16	.19
2. Positive Affect T1	---	-.20	.45	-.02	.34	-.07
3. Negative Affect T1		---	-.20	.41	-.09	.26
4. Positive Affect T2			---	-.15	.53	-.10
5. Negative Affect T2				---	-.10	.44
6. Positive Affect T3					---	-.27
7. Negative Affect T3						---
Grade 9 Cohort						
1. Age at T1	-.05	.05	.21	-.07	.23	.12
2. Positive Affect T1	---	-.13	.45	-.10	.34	-.14
3. Negative Affect T1		---	-.00	.48	-.08	.36
4. Positive Affect T2			---	-.23	.44	-.05
5. Negative Affect T2				---	-.25	.52
6. Positive Affect T3					---	-.33
7. Negative Affect T3						---

Note. Grade 3 NA and PA at T1 not included in analyses (see Methods for further details). All *r* values greater than |.14| are significantly different from 0 at $p < .05$.

Table 3

Fit Statistics for Affective Growth Models

	χ^2 (df)	CFI	RMSEA [90% CI]	SRMR	AIC	BIC
Positive Affect (PA)						
Grade 3 Cohort[1]						
No-growth	2.79 (1)	.95	.10 [.00, .25]	.04	2360.48	2373.27
Grade 6 Cohort						
No-growth	29.16 (4)	.78	.16 [.11, .22]	.11	4568.54	4586.11
Linear growth	.52 (1)	1.00	.00 [.00, .15]	.01	4545.91	4574.01
Grade 9 Cohort						
No-growth	33.45 (3)	.62	.18 [.13, .24]	.13	3931.40	3948.44
Linear growth	.11 (1)	1.00	.00 [.00, .12]	.01	3904.07	3931.32
Negative Affect (NA)						
Grade 3 Cohort[1]						
No-growth	1.08 (1)	.98	.02 [.00, .20]	.03	2304.97	2317.76
Grade 6 Cohort						
No-growth	9.02 (4)	.94	.07 [.00, .13]	.06	4629.43	4647.00
Linear growth	3.66 (1)	.97	.10 [.00, .23]	.03	4630.07	4658.18
Grade 9 Cohort						
No-growth	5.33 (4)	.99	.04 [.00, .11]	.05	4066.43	4083.44
Linear growth	1.05 (1)	1.00	.01 [.00, .18]	.02	4068.14	4095.36

[1]For grade 3 cohort, we were unable to model linear growth, as data were only available for two time points; thus, only no-growth models were tested (see Method for further details).

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; AIC = akaike information criteria; BIC = bayesian information criteria.

Table 4

Parameter Estimates for Best-Fitting Models

	Intercept				Linear Slope			
	b (SE)	**ß**	**z**	**p**	**b (SE)**	**ß**	**z**	**p**
Means								
Models of PA								
Grade 3 Cohort	44.79(.58)	7.48	76.95	.000	-	-	-	-
Grade 6 Cohort	45.01(.51)	7.60	88.80	.000	-1.58(.34)	-.52	-4.71	.000
Grade 9 Cohort	43.85(.53)	6.87	82.52	.000	-1.80(.33)	-.61	-5.41	.000
Models of NA								
Grade 3 Cohort	23.50(.47)	7.02	49.97	.000	-	-	-	-
Grade 6 Cohort	26.14(.44)	4.81	58.93	.000	-	-	-	-
Grade 9 Cohort	28.33(.54)	4.29	52.57	.000	-	-	-	-
Variances								
Models of PA								
Grade 3 Cohort	35.85(6.95)	1.00	5.16	.000	-	-	-	-
Grade 6 Cohort	35.10(8.44)	1.00	4.16	.000	9.18(4.29)	1.00	2.14	.033
Grade 9 Cohort	40.73(9.80)	1.00	4.16	.000	8.62(4.45)	1.00	1.94	.053
Models of NA								
Grade 3 Cohort	11.21(5.40)	1.00	2.07	.038	-	-	-	-
Grade 6 Cohort	29.52(4.62)	1.00	6.39	.000	-	-	-	-
Grade 9 Cohort	43.53(6.30)	1.00	6.91	.000	-	-	-	-

Note. PA = positive affect; NA = negative affect

CHAPTER 6: FIGURES

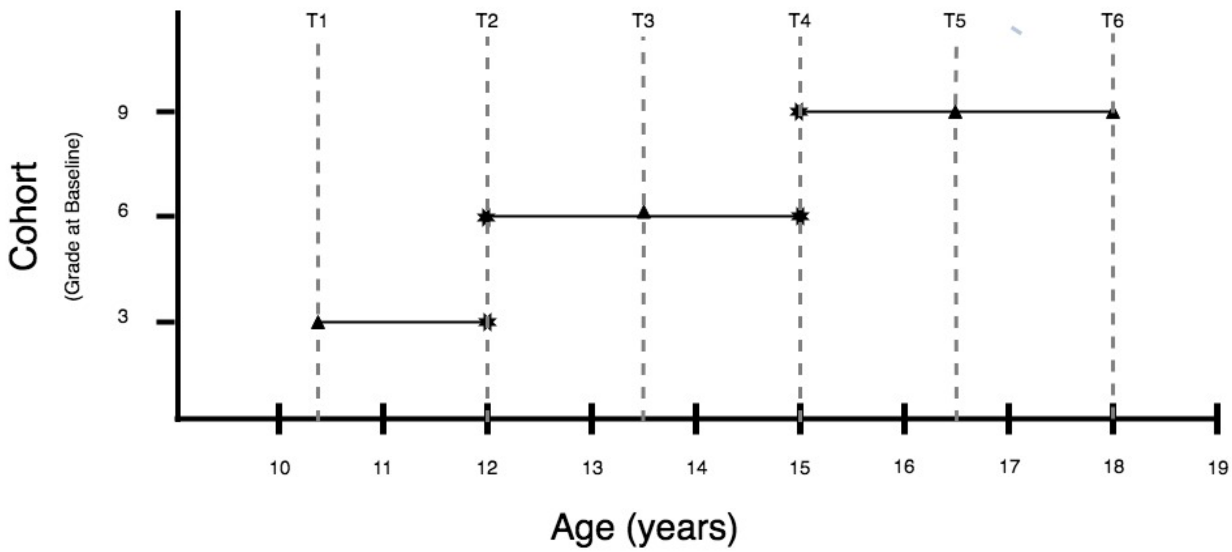

Figure 1. An illustration of PANAS-C assessment points using the accelerated longitudinal cohort design, with triangles indicating cohort-specific assessment points and stars indicating overlapping assessment points between cohorts.

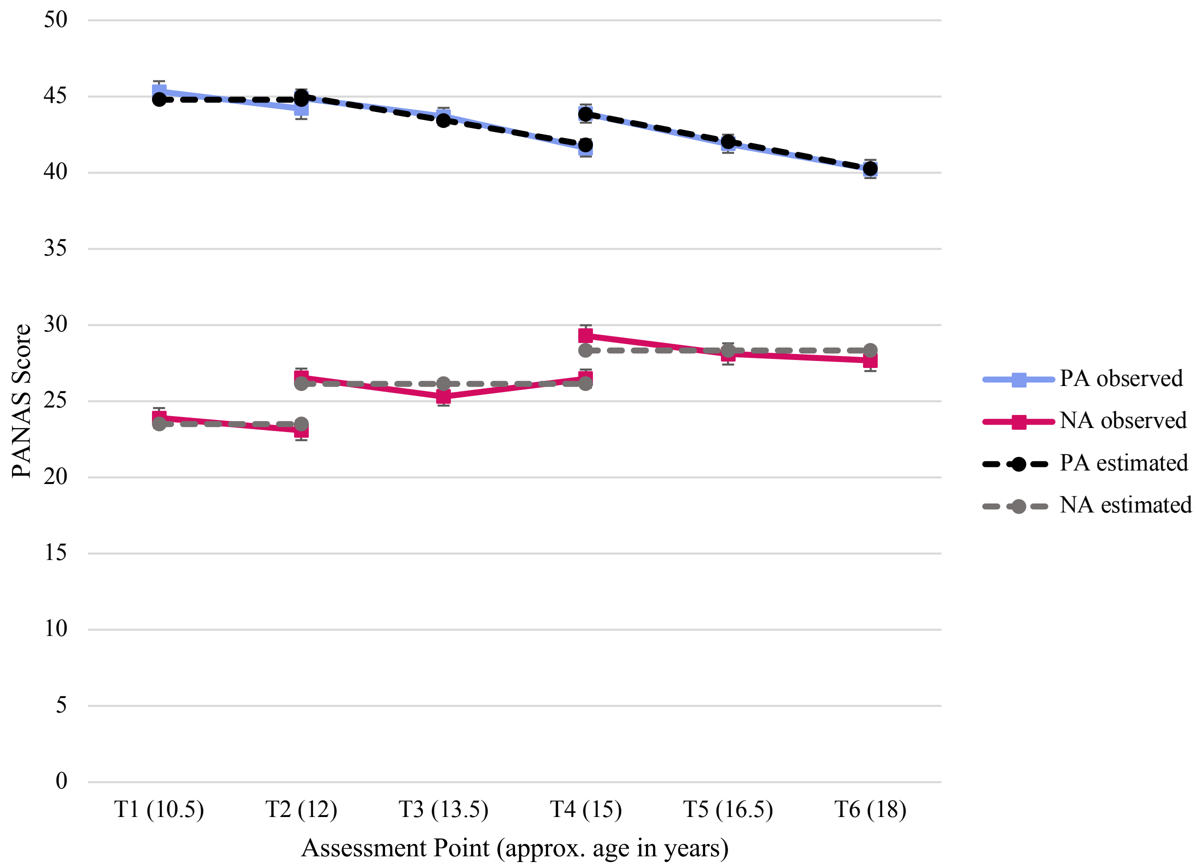

Figure 2. A descriptive timeline of observed and estimated negative affect (NA) and positive affect (PA) development from late childhood to late adolescence using PANAS mean scores. Error bars have been added to represent standard errors of the observed means.

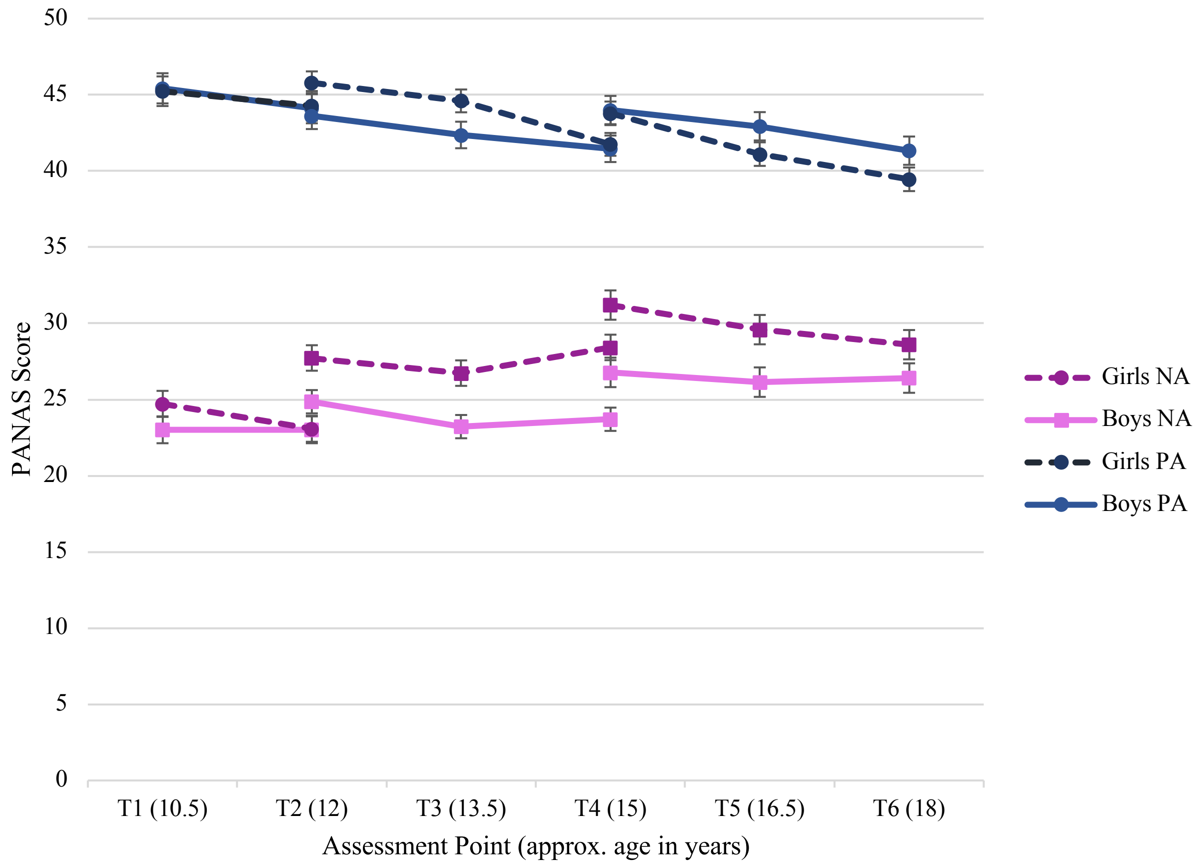

Figure 3. A descriptive timeline of negative affect (NA) and positive affect (PA) development from late childhood to late adolescence using PANAS mean scores, plotted by gender. Error bars have been added to represent standard errors of the mean.

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APPENDIX A: SUPPLEMENTARY TABLES

Table 5

Fit Indices for Growth Models Including Gender as a Covariate

	χ^2 (df)	CFI	RMSEA [90% CI]	SRMR	AIC	BIC
Positive Affect (PA)						
Grade 3 Cohort[1]						
No-growth	2.86 (2)	.97	.05 [.00, .15]	.03	2954.99	2971.70
Grade 6 Cohort						
Linear growth	1.62 (2)	1.00	.00 [.00, .12]	.02	5240.90	5276.03
Grade 9 Cohort						
Linear growth	.73 (2)	1.00	.00 [.00, .10]	.01	4533.17	4567.25
Negative Affect (NA)						
Grade 3 Cohort[1]						
No-growth	2.05 (2)	.99	.01 [.00, .14]	.03	2898.62	2915.33
Grade 6 Cohort						
No-growth	11.16 (6)	.95	.06 [.00, .11]	.05	5310.80	5331.88
Grade 9 Cohort						
No-growth	7.10 (6)	.99	.03 [.00, .10]	.04	4686.91	4707.36

[1]For grade 3 cohort, we were unable to model linear growth, as data were only available for two time points; thus, only no-growth models were tested (see Method for further details).

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; AIC = akaike information criteria; BIC = bayesian information criteria.

Table 6

Parameter Estimates for All Cohort Models

	Intercept				Linear Slope			
	b (SE)	**ß**	**z**	**p**	**b (SE)**	**ß**	**z**	**p**
Means								
No-growth Models of PA								
Grade 3 Cohort	44.79(.58)	7.48	76.95	.000	-	-	-	-
Grade 6 Cohort	43.67(.44)	7.93	98.74	.000	-	-	-	-
Grade 9 Cohort	42.45(.46)	8.20	91.44	.000	-	-	-	-
Linear Models of PA								
Grade 3 Cohort	-	-	-	-	-	-	-	-
Grade 6 Cohort	45.01(.51)	7.60	88.80	.000	-1.58(.34)	-.52	-4.71	.000
Grade 9 Cohort	43.85(.53)	6.87	82.52	.000	-1.80(.33)	-.61	-5.41	.000
No-growth Models of NA								
Grade 3 Cohort	23.50(.47)	7.02	49.97	.000	-	-	-	-
Grade 6 Cohort	26.14(.44)	4.81	58.93	.000	-	-	-	-
Grade 9 Cohort	28.33(.54)	4.29	52.57	.000	-	-	-	-
Linear Models of NA								
Grade 3 Cohort	-	-	-	-	-	-	-	-
Grade 6 Cohort	26.29(.54)	4.09	49.16	.000	-.06(.37)	-.02	-.16	.870
Grade 9 Cohort	29.05(.66)	4.20	44.36	.000	-.75(.41)	-.32	-1.80	.071
Variances								
No-growth Models of PA								
Grade 3 Cohort	35.85(6.95)	1.00	5.16	.000	-	-	-	-
Grade 6 Cohort	30.36(4.33)	1.00	7.02	.000	-	-	-	-
Grade 9 Cohort	26.54(4.40)	1.00	6.03	.000	-	-	-	-

Table 6 (continued)

Linear Models of PA								
Grade 3 Cohort	-	-	-	-	-	-	-	-
Grade 6 Cohort	35.10(8.44)	1.00	4.16	.000	9.18(4.29)	1.00	2.14	.033
Grade 9 Cohort	40.73(9.80)	1.00	4.16	.000	8.62(4.45)	1.00	1.94	.053
No-growth Models of NA								
Grade 3 Cohort	11.21(5.40)	1.00	2.07	.038	-	-	-	-
Grade 6 Cohort	29.52(4.62)	1.00	6.39	.000	-	-	-	-
Grade 9 Cohort	43.53(6.30)	1.00	6.91	.000	-	-	-	-
Linear Models of NA								
Grade 3 Cohort	-	-	-	-	-	-	-	-
Grade 6 Cohort	41.31(10.08)	1.00	4.10	.000	11.90(5.11)	1.00	2.33	.020
Grade 9 Cohort	47.92(11.90)	1.00	4.03	.000	5.33(6.23)	1.00	.86	.392

Note. PA = positive affect; NA = negative affect

Table 7

Fit Indices for Growth Models for the Overall Sample Including Grade Cohort as a Covariate

	χ^2 (df)	CFI	RMSEA [90% CI]	SRMR	AIC	BIC
Positive Affect (PA)						
No-growth	63.98 (6)	.77	.12 [.10, .15]	.08	13802.42	13829.30
Linear growth	.35 (2)	1.00	.00 [.00, .04]	.01	13746.79	13791.59
Negative Affect (NA)						
No-growth	11.71 (6)	.98	.04 [.00, .07]	.03	13959.76	13986.64
Linear growth	3.05 (2)	1.00	.03 [.00, .09]	.02	13959.10	14003.90

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; AIC = akaike information criteria; BIC = bayesian information criteria.